

BETO 2023 Peer Review



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April 3, 2023



Overview

- **Drive Deeper Integration Across DOE Programs**
- **BETO Multi Year Program Plan (MYPP) Update**
- **SAF Grand Challenge Roadmap update**

Transportation Decarbonization: Strategy Launched and Rolled out

THE U.S. NATIONAL BLUEPRINT FOR TRANSPORTATION DECARBONIZATION

January 10, 2023

- Historic announcement including four government agencies and the Executive Office of the President
- Joined by representation from the entire spectrum of stakeholders
- Reflects the government, non-profit, and industry shared commitment to decarbonizing the transportation sector









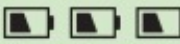
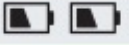



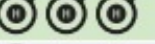
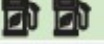
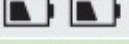


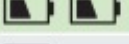
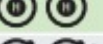
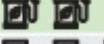

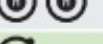
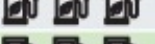


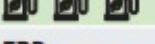
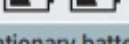
[Watch the video](#)



Clean Solutions for All Modes

Achieving net-zero emissions will require a suite of technology solutions across all modes of transportation.

- Build on existing federal commitments
- Leverage **market forces** for widescale deployment of cost-effective technologies
- Focus on solutions that can be **incrementally deployed** to deliver results by 2030
- Address full lifecycle emissions and grid integration
- Multiple solutions and actions can improve mobility options and offer **more affordable, energy-efficient, and cleaner alternatives.**

	 BATTERY/ELECTRIC	 HYDROGEN	 SUSTAINABLE LIQUID FUELS
1 icon represents limited long-term opportunity  2 icons represents large long-term opportunity  3 icons represents greatest long-term opportunity 			
Light Duty Vehicles (49%)*		—	TBD
Medium, Short-Haul Heavy Trucks & Buses (~14%)			
Long-Haul Heavy Trucks (~7%)			
Off-road (10%)			
Rail (2%)			
Maritime (3%)			
Aviation (11%)			
Pipelines (4%)		TBD	TBD
Additional Opportunities	<ul style="list-style-type: none"> • Stationary battery use • Grid support (managed EV charging) 	<ul style="list-style-type: none"> • Heavy industries • Grid support • Feedstock for chemicals and fuels 	<ul style="list-style-type: none"> • Decarbonize plastics/chemicals • Bio-products
RD&D Priorities	<ul style="list-style-type: none"> • National battery strategy • Charging infrastructure • Grid integration • Battery recycling 	<ul style="list-style-type: none"> • Electrolyzer costs • Fuel cell durability and cost • Clean hydrogen infrastructure 	<ul style="list-style-type: none"> • Multiple cost-effective drop-in sustainable fuels • Reduce ethanol carbon intensity • Bioenergy scale-up

* All emissions shares are for 2019

† Includes hydrogen for ammonia and methanol

Overview

- Drive Deeper Integration Across DOE Programs
- **BETO Multi Year Program Plan (MYPP) Update**
- SAF Grand Challenge Roadmap update

Safety is Job #1



Biohazard



Electric Shock

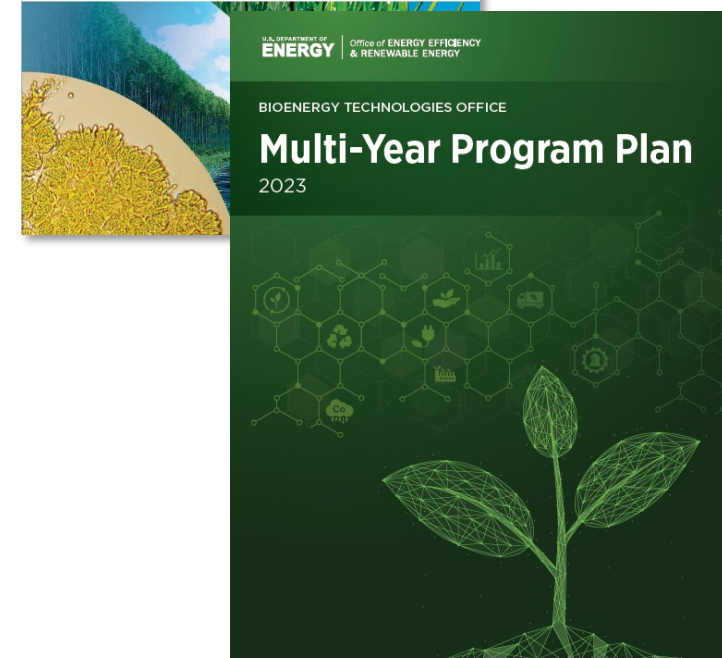


Toxic Hazard



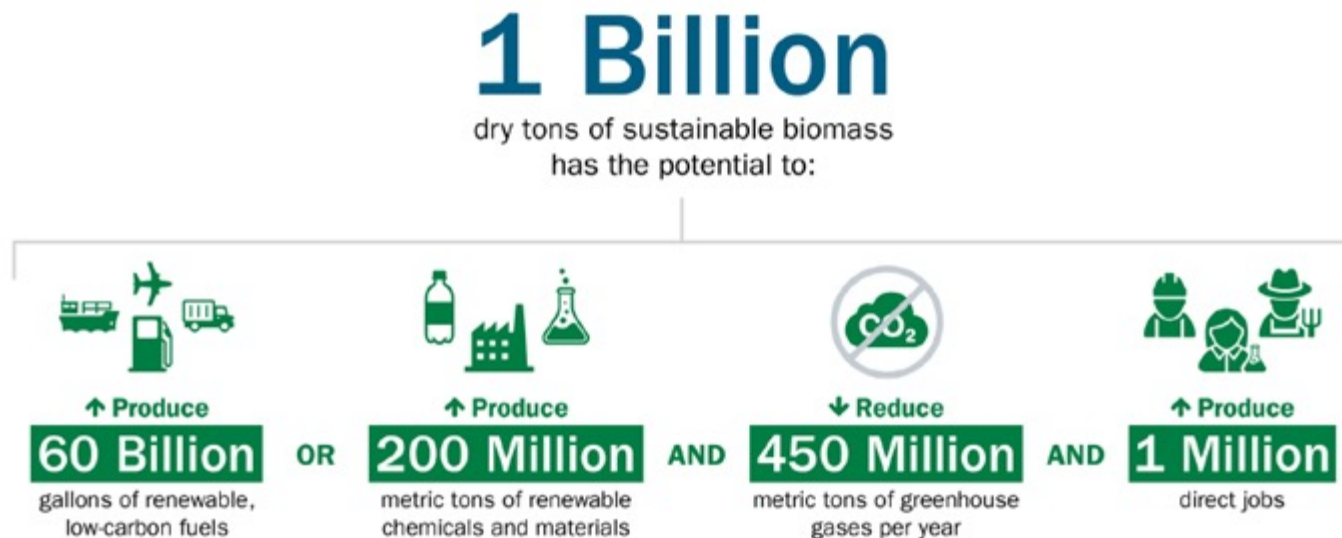
Need for an MYPP Update

- BETO's MYPP was last published in March 2016, now outdated.
- Changes from 2016:
 - ✓ Move away from pathway cost reductions exclusively.
 - ✓ Emphasized accelerating GHG reductions.
 - ✓ Emphasized Hard to De-carbonize areas of the Economy.
- Opportunity to better articulate our strategy to the public by:
 - ✓ Using plain language.
 - ✓ Focusing on priorities.
 - ✓ Keeping content evergreen where possible.



Key Themes

- More GHG reductions, faster!
- Focusing on SAF and other strategic transportation fuels.
- Unlocking the potential of the full range renewable carbon resources.
- Creating market pull through high-ROI opportunities (e.g., chemicals).
- Expanding beneficial-use cases for relevant technologies (e.g., waste management).



BETO Mission & Goals: Decarbonize Transportation

Strategic Goal

Decarbonize the sector through R&D to produce cost effective sustainable aviation and other strategic fuels.



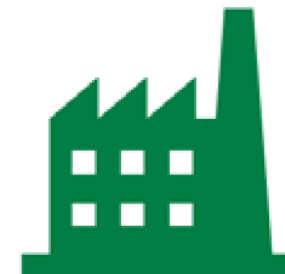
2030 Performance Goal

- Produce and process sufficient biomass feedstock to meet industry relevant cost and performance requirements focusing on SAF with a >70% GHG reduction.
- Support scale up of at least four demonstration-scale integrated biorefineries with a focus on SAF capable of >70% GHG reduction.
- Support efforts to produce 3 billion gallons of domestic SAF production and use.

BETO Mission & Goals: Decarbonize Industry

Strategic Goal

Decarbonize the sector through R&D to produce cost effective sustainable chemicals, materials and processes utilizing biomass and waste resources



2030 Performance Goal

- Enable production of >10 renewable chemicals and materials with >70% GHG reduction.
- Enable at least one cost-effective and recyclable bio-based plastic that mitigates $\geq 50\%$ GHG emissions.

BETO Mission & Goals: Decarbonize Communities

Strategic Goal

Develop cost-effective, sustainable biomass and waste utilization technologies and innovative approaches contributing to the decarbonization of agricultural sector, generating carbon negative power, developing carbon drawdown strategies or other beneficial uses.



2030 Performance Goal

- Demonstrate more than three place-based strategies for climate smart agriculture, waste management, environmental remediation, or other beneficial uses of renewable carbon resource.

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- **SAF Grand Challenge Roadmap update**

SAF Grand Challenge Timeline and Goals

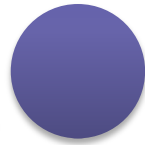
Sep 2021
White House
Announcement



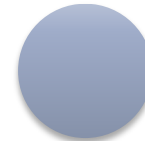
Nov 2021
U.S. Aviation Climate
Action Plan



Sep 2022
Grand Challenge
Roadmap



Jan 2023
Transportation
Decarbonization Plan



2030
3 BGY Goal



2050
35 BGY Goal



What We Need to Be Successful

- **Create an environment where producers choose to produce and sell sustainable aviation fuel (SAF)**
 - Legislative action to reduce cost and risk – Inflation Reduction Act
- **A coordinated approach to federal actions that derisks technology, supply chains, and markets, and reduces barriers**
 - Actions that support near-term production
 - Ongoing innovation to support future production
 - Data collection and analysis to support markets for SAF through strong policies
- **Industry to build and purchase SAF supply**

SAF Grand
Challenge
Roadmap



SAF Grand Challenge Roadmap



U.S. Departments of Energy, Transportation, and Agriculture launched the SAF Grand Challenge through a Memorandum of Understanding (MOU). Goals include:

- Achieving a minimum of a 50% reduction in life cycle greenhouse gas emissions compared to conventional fuel.
- Supplying sufficient SAF to meet 100% of aviation fuel demand by 2050.



Roadmap Purpose

- A multi-agency plan of federal agency action
- Supports stakeholders to build the SAF supply
- Derisk technology, supply chains and markets, and reduce barriers by:
 - Leveraging existing government research, development, demonstration, and deployment support
 - Accelerating new research, development, demonstration, and deployment support
 - Supporting policy framework



Roadmap Implementation – Next Steps

- Federal agency involvement
 - Map existing and planned activities aligned with Roadmap
 - Identify RDD&D gaps and funding needs
- Stakeholder engagement
 - Obtain external stakeholder input on federal activity plans
 - Provide recommendation on research focus areas
 - Identify/map industry supported/funded efforts aligned with Roadmap
 - Identify opportunities for public-private partnerships to implement Roadmap actions (e.g. working groups/technical teams)
- Communications
 - Develop and launch a SAF Grand Challenge Website
 - Planning for an FY23 Roadmap Annual Progress Report



Inflation Reduction Act - Provisions for SAF

**Signed into law by President Biden on 08/16/2022*

SAF Tax Credits

- Section 13203 SAF Credit
- SAF must achieve >50% greenhouse gas (GHG) reduction to be eligible
- Tax credit starts at \$1.25/gallon of neat SAF and increases by \$0.01/gal for each percentage point improvement in GHG performance up to \$1.75/gal
- Credits can be “stacked” with Renewable Identification Numbers (RIN) and state Low Carbon Fuel Standard (LCFS) credits
- Section 13704 Clean Fuel Production Credit



- **Josh Messner, Colleen Tomaino, Brian Cooper, Stacey Young**
- **The Bioenergy Technologies Team**
- **PIs and Teams**
- **Reviewers**

**THANK
YOU**